

Low Female Labor Force Participation in the Gulf:

*Cultural preferences or a necessary
consequence of large oil rents?*

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Preface

Writing this thesis has been a very positive and enjoyable process from which I have learned a lot. I am very grateful for all the encouragement and supervision I have received from my supervisor Halvor Mehlum. I would also like to thank Tarjei Havnes for his patience with all my questions regarding STATA and his involvement in the econometric part of my thesis.

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A last word of thanks goes to Michael Ross who has generously shared his data with me.

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1 Summary

Given that female labor force participation seems to have been a driving factor in the empowerment of women many places in the world, it is interesting to note that this is not the case in the Middle East and North Africa (MENA). According to the World Bank (2004) the region has been successful in closing the gender gap in education and health. The development in parameters used to measure progress in the empowerment of women, such as female life expectancy, ratio of girls to boys in primary and secondary education and reduction in fertility rates, has been about the same in MENA as in other developing regions. However, when considering female labor force participation in non-agricultural sectors and the percentage of parliamentary seats held by women, the region scores significantly below the average for developing regions. This indicates that there might be some features of the society and economies in these countries that makes it particularly hard for women to gain access to the labor market.

In 2008, Michael Ross published an article "Oil, Islam, and Women" where he in the introduction asserts that "... women in the Middle East are underrepresented in the work force and in government because of oil – not Islam." I use Ross' data and find that his regression is misleading and his conclusion too harsh. By including an interaction term between Islamic influence and a country's oil rents I find that it is the *combination* of large oil rents and Islamic presence that has a negative effect on women's labor force participation. This result is significant, while oil rent on its own has no significant effect at all. These findings are in accordance with the observation that the oil rich countries in the Gulf region have among the lowest rate of female labor force participation in the world, while Norway, a country which also exhibit large oil rents, has among the highest female labor force participation in the world. Furthermore, it relates well to the fact that the oil rich countries in MENA has significantly lower female labor force participation than the average in the rest of the region.

I develop a model where women can face either a high or a low social cost if they choose to join the labor force. There are two types of households: skilled and unskilled. Skilled women can participate in the labor force on the same conditions as men, but only if they can buy household services in the market. Market provided household services are

supplied by unskilled women. This generates two different equilibria: When the social cost is low, many women choose to work, which in turn increase the demand for female labor. If however the social cost is high, all women prefer to stay out of the labor market.

The model is also suitable to study how the effect of large oil rents on female labor force participation depends on how these rents are integrated in the economy. If households receive large transfers of income from the authorities, the effect may very well reduce the female labor force participation. When women in addition face a substantial social cost if she take a job outside the family, the reduction is likely to be even larger. In cases where oil rents rather are used to subsidize childcare, which facilitate women's entry into the labor force, their participation will increase. This is true independent of whether the social cost is high or low, but if the cost is high, the subsidy has to be larger in order to have the intended effect.

The conclusion is thus that large oil rents have the effect of loosening a society's budget constraint. A country with a conservative and traditional view on women's role in the society may prefer to use the money in a way that make women stay home, while a country with opposite preferences may finance arrangements that facilitate women's labor force participation. The Islamic tradition in the Middle East and North Africa impose a higher social cost on women who enter the the labor market. In combination with large oil rents, this explain the low female labor force participation in the Gulf.

2 Introduction

When studying the oil rich countries surrounding the Persian Gulf, it is some characteristics they seem to have in common: They have all a large majority of Muslims in their population; they do all benefit from a substantial oil rent per capita; and they all experience a very low female labor force participation. In my master thesis I investigate the links between these three characteristics in an attempt to say something about a causal relationship between any of them.

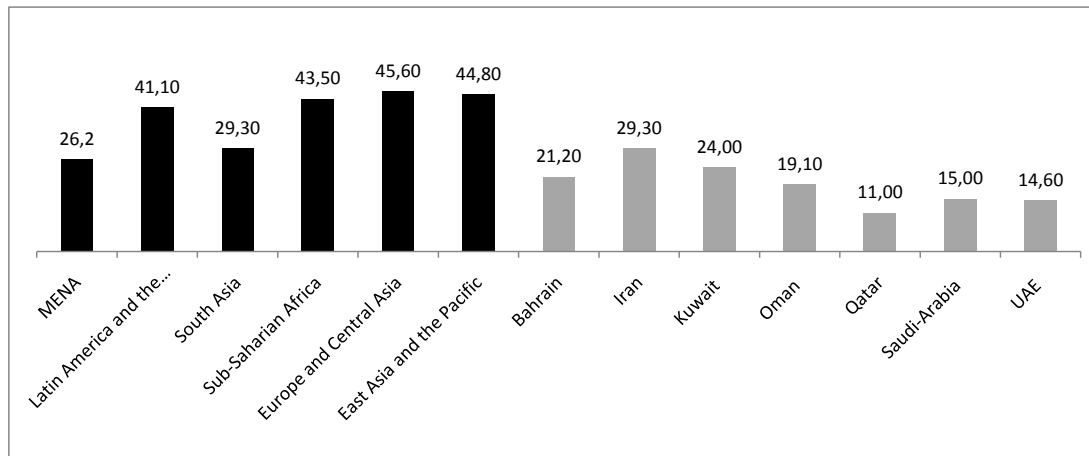
2.1 Female Labor Force Participation in the Gulf

In 2004 the World Bank issued a report concerning gender and development in the Middle East and North Africa (MENA¹). The report points to the fact that women in this region participate less in the labor force and have lower political influence than women elsewhere in the world. According to numbers from the World Bank (see figure 1), the average level of women in the labor force in MENA was only 26.2 percent in 2007. As one can see, women's labor force participation is particularly low in the countries surrounding the Persian Gulf. Qatar, where women only constitute 11 percent of the total labor force, has the lowest number, and all countries but Iran have a number below the MENA average.

Research has shown that female labor force participation tend to improve women's situations in other measures of gender equality and the empowerment of women. The link between female labor force participation and the effect on female education was investigated by Michael (1985). He found by analyzing US data from 1950 to 1980 that lagged values of female labor force participation is positively correlated with the fraction of college and advanced degrees earned by women. Interestingly the contrary, lagged values of higher education among women on female labor force participation, has no significant effect. A credible explanation is that families tend to invest more in girls' education when they know that girls will be able to earn their own income and contribute to the household total income.

¹MENA includes all Middle Eastern and North African countries, also those around the Persian Gulf. The list of countries is as follow (Gulf countries are marked with an asterisk): Algeria, Bahrain*, Djibouti, Egypt, Iran*, Iraq*, Jordan, Kuwait*, Lebanon, Libya, Morocco, Oman*, Palestine, Qatar*, Saudi Arabia*, Syria, Tunisia, United Arab Emirates* and Yemen.

Figure 1: Female as percent of total labor force, 2007.



Source: World Bank

The literature review of Brewster and Rindfuss (2000) concludes that in industrialized countries, where the combination of work and looking after children is difficult, women who wish to participate in the labor force resolve to a combination of limiting their fertility and making other arrangements for childcare, and the total effect of female employment on fertility rates are therefore most likely negative.

For women, entering the labor force increases the contact with other women, facilitates sharing of information and lower the barriers to collective actions. In Norway for example, women employed at a factory producing matches in Christiania where among the very first to use strike as a bargaining tool in their fight for higher wages and better working conditions in October 1889 (Bjørnson, 1993).

Given that female labor force participation seems to have been a driving factor in the empowerment of women many places in the world, it is interesting to note that this is not the case in the Middle East and North Africa. According to the World Bank (2004) the region has been successful in closing the gender gap in education and health. The development in parameters used to measure progress in the empowerment of women, such as female life expectancy, ratio of girls to boys in primary and secondary education and reduction in fertility rates, has been about the same in MENA as in other developing regions. However, when considering female labor force participation in non-agricultural sectors and the percentage of parliamentary seats held by women, the region scores significantly below the average for developing regions. This indicates that there might be

some features of the society and economies in these countries that makes it particularly hard for women to gain access to the labor market.

In the book *Social Changes and Women in the Middle East: State Policy, Education, Economics and Development* from 1999, Shirin Shukri discusses how the economic development and state policy have affected women's employment decision in the Middle East. The main pattern of industrialization between 1955 and 1975 was that of import substitution industrialization, meaning that countries industrialized in order to be able to substitute consumption away from imported and over to domestically produced goods. This industrialization pattern has traditionally reduced women's work opportunities and favored male labor. Countries rich on oil and poor on other resources chose an industrial strategy based on petroleum products and petrochemicals. These industries are highly capital intensive, require only a minimum of labor, and the development of these industries rarely results in high female employment. By 1980, some countries, mainly those poor on oil, turned to export oriented industrialization, where the production process often is more labor intensive, and do not necessarily require skilled labor. This might have resulted in an increase in job opportunities for women.

The rise in oil prices at the beginning of the 1970's led to a massive flow of male labor from capital poor to capital rich countries in the region. As a consequence, some countries experienced that the working age population in rural areas became dominated by women. In this period with rapid growth, several countries encouraged women to take active part in the labor force, some even issued laws to protect women during pregnancy and required there to be nurseries in close relation to the work place.

The World Bank (2004) includes a historical perspective on gender equality in MENA, and describes the same urge from governments to emancipating women as part of the overall modernization of the state and economy during the three decades after 1950. However, these reforms were introduced from the top and faced substantial resistance at the grass root level of the population. Gender related reforms were seen as elite driven and became an important symbol of modernization and westernization. Nevertheless, female labor force participation continued to grow as long as there were growth in the health and education sectors. The oil boom in the mid-1970s increased the real wages in the economy, and it became possible to increase a family's standard of living even with only one family

income. In addition, the state led development in many of the oil exporting countries focused on construction and infrastructure, sectors that favor male labor. Throughout the 1980's the region experienced an economic slowdown. Unemployment rates increased and questions were risen on whether women's participation in the labor force were beneficial for the economy. A popular view was that men should be preferred on the job market since they had to support a family. Several countries even took direct measure to reduce female employment. After 1990, gender equality has received more attention. The economic situation has changed, most families now need two incomes, and the successful education policy has resulted in an increasing group of highly educated women who want access to the labor market.

2.2 The Case of Saudi Arabia

Saudi Arabia is an Islamic monarchy situated on the west side of the Persian Gulf and is the largest country on the Arabian peninsula. The country is governed based on a strict interpretation of the Islamic law sharia, and ruled by the royal family. The country is the number one oil producing country in the world, and it is assumed to hold between 1/5 and 1/4 of the world's oil reserves. Figures from the Saudi Arabia Ministry of Economy and Planning (2009) shows that in 2006, 90 percent of the public revenues came from oil, and the oil sector constituted 27.5 percent of GDP. Services accounted for approximately 46 percent, while non-oil manufacturing only accounted for less than 12 percent . With such a large fraction of public revenues stemming from oil, and non-oil manufacturing not even accounting for 12 percent of GDP, it is clear that the the Saudi economy is extremely dependent of oil.

Saudi Arabia experienced a huge transformation during the second half of the 20th century. According to the World Development Indicators database, Saudi Arabia's GDP measured in constant 2000 US dollars was in 2008 almost seven times that in 1968. Over the the same period, the population had increased to about 4.6 times that in 1968. According to Rivlin (2009) the population growth was encouraged by the authorities because it was assumed to be necessary with a larger population in order to defend the oil revenues and the large geographical area.

A word of caution is in place when discussing Saudi Arabian statistics. Figures from the UN and the Saudi official figures tend to differ quite considerably and while Saudi Arabian official figures estimates that more than half of the country's labor force are foreigners, the Economist Intelligence Unit estimated that foreigners constituted 78.2 percent of total Saudi labor force (Rivlin, 2009: table 10.4) The authorities has an expressed wish to make Saudi Arabia less dependent on expatriate labor, but their own estimates states that the share increased from 52.7 percent in 2003 to 54.4 percent in 2006. According to the country's Eight Development Plan,² the main trend in the labor market can be summarized as follow: Saudi workers work in the service sector (32.6 percent) and with scientific and technical jobs (25.9 percent) while foreigners work in production and transportation (39 percent) and in services (28.4 percent).

Saudi employees constitute approximately 33 percent of the labor force in the total private sector, and only about 27 percent of those employed in productive private sector (calculated from table 8.3 in the Eight Development Plan), while they account for around 90 percent of the work force in the public sector. Saudis perceive a job in the public sector as more lucrative than working in the private sector, and rather than go working in the private sector, they prefer to go unemployed until they can get a government position. This phenomenon is discussed both by Richards and Waterbury (2008) and in the Eight Development Plan. In the latter, the authorities claim that employment in the public sector has reached its point of saturation and that new employment opportunities will have to come in the private sector. Combined with the expressed wish of reducing the country's dependency on expatriate labor, they are therefore concerned about how to solve the matching problem in the labor market. Saudi nationals find work in the private sector unattractive since wages are lower and benefits less than in the public sector. On the other hand, private companies do not find the skills and qualification they search among the Saudi labor force. The government therefore focus on job training programs that make Saudis better qualified for work in the private sector.

Another step in the authorities plan to "Saudiify" the economy, i.e. reduce the Saudi economy's dependence on foreign labor, is to increase the labor force participation among

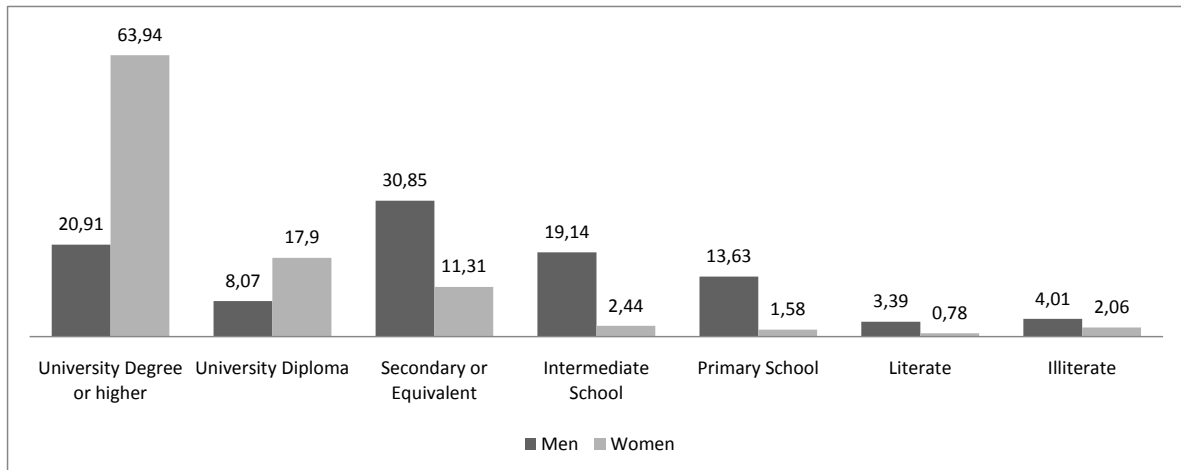
²Since 1970 Saudi Arabia has issued five-year plans in order to promote social and economic development. These plans and the evaluation of them are available in English at the Ministry of Economy and Planning's web page: <http://www.mep.gov.sa/>

Saudi women. In 2003, the national labor force counted 3.30 million workers, with women only representing 12.2 percent. Among those women who worked, more than 50 percent held qualifications beyond the secondary phase of education, a figure that had increased to almost 64 percent in 2008 (see figure 2). In the evaluation of the country's implementation of the UN-millennium goals, the Saudi authorities congratulate them self on the success in having closed the gender gap in education. Figure 2 illustrate why this is an extremely important achievement: Although the overall labor force participation among Saudi women is low, those women who do work hold higher education. In many western countries one observes that women first gained access to the labor market through industries that require little or none education and brawn. Saudi women seem to do it the other way around. They first get the education, and then gain access to the labor market. The Eight Development Plan confirm this picture and states that the female labor force participation is far higher among women with post secondary education compared to those with less education, respectively about 71 percent and only 10.5 percent.

Black and Juhn (2000) investigate the question of whether women actually do respond by increasing their labor supply as the demand for skilled labor increases. They use US earning and employment data for the years 1967-1998 and find that the observed increased participation among college educated women in traditionally male professional occupations to some extent can be explained as a response to increased demand for skilled labor. Although they cannot separate the effect from that due to reduced discrimination, they conclude that the concurrent increase in demand for skilled labor and reduction in discrimination against women probably are related. The increased female labor force participation among Saudi women in recent years may reflect the same effect. Increased demand for skilled Saudi labor reduces the weight put on women's role in the home and increases the effort to organize workplaces so that they are suitable for female employees. This happen at the same time as women increase their labor supply because the return on skilled labor increases.

85.8 percent of all working women are employed in the teaching and education sector. Another 10 percent work in the health sector and the public administration. This is in accordance with the general pattern described by Richards and Waterbury (2008). People judge work in the public sector far more attractive than private sector jobs. These

Figure 2: Distribution of Education among Saudi Employee, 2008



Source: Figure 3.1, chapter 3, Millennium Development Goals, Saudi Arabia Ministry of Economy and Planning

jobs have higher status, offer regular and short working hours and provide the employees with better benefits. Families are especially concerned with their daughters' and wives' reputation. It is important that their employment is perceived as respectable and Islamic law put strict regulations on women's contact with men outside the families. This make it difficult for the private sector to employ women. Families therefore often choose to support unemployed women as long as possible while waiting for a respectable job in the public sector. This might explain why one observes so few working women among those with low education. With low education those jobs available are low paid and have low status. Accepting a job like that might reduce a woman's attractiveness as a future wife or disgrace her husband and the rest of the family. The social cost of letting women work under such conditions might outweigh the cost for the family of supporting her at home.

Kathryn Coughlin (2006) gives a brief description of all limitations and obstacles Saudi women face in the society: The way the Islamic law is interpreted in Saudi Arabia (*wahhabism*) dictates people's appearance in public and a demand a strict segregation of the sexes. Saudi women are either under ward of their father, husband or son. They are not allowed to buy mobile phones, register for college classes, accept marriage without male approval or to attend to court hearings. Saudi women are neither allowed to drive nor allowed to be alone in a car without a male relative. They do not have a birth certificate and cannot obtain a passport without a male relative. In the country's only election ever, a municipal election in 2004, women could not vote, not because they were legally

constrained but because of the administrative problems. There were not enough women available to control the identity of other female voters, and the fact that many Saudi women do not have identification papers with picture, further complicated the issue.

Coughlin also argue that it is no longer the traditional view of women's role in the home that is the main obstacle for Saudi women who want to go to school and join the labor force. Rather the hindrance is how to solve the problem of the mixing of sexes that is deemed to occur when women join the labor force.

2.3 The Impact of Large Resource Rents in Norway

Michael Ross (2008) argues that the structural changes in an economy with large oil rents is the reason why we observe a female labor force participation in MENA far below that observed in other regions. I will discuss his article thoroughly in section 3, but before doing that I find it useful to summarize the main findings of Mehlum et al. (2008) in their working paper "Mineral Rents and Social Development in Norway".

Mehlum, Moene and Torvik investigate which factors it is that can explain why Norway has succeeded in escaping the resource curse. The resource curse is a term used to describe the observed, strong empirical correlation between a country's resource abundance and low economic growth. Mehlum, Moene and Torvik point at several important aspects of the economic development in Norway after the oil production began in 1973, a few of which I find it relevant to mention here in the discussion of female labor force participation.

Throughout the second half of the 20th century Norway observed a marked increase in the service sector. However, this did not force down the employment in other sectors because the share of women participating in the labor force increased from less than 40 to almost 80 percent over the same time period. A boom in subsidized higher education and increased provision of day care for children facilitated the rise in female labor force participation.

Further, the fact that oil was discovered off-shore and hence required more complicated technical solutions, has also necessitated the development of a new sea drilling industry, an industry that today is among the world leaders.

Norway is also among the countries that industrialized early. The labor movement has had a strong position in more than 100 years, and has been an important factor in the fight for suffrage and social development. The Norwegian democracy is organized with a parliamentary system of government, and an election system with proportional representation. This results in a broader representation than in a majoritarian system which in turn tend to favor public spending on universal programs that potentially benefit all citizens.

Lastly, since oil was discovered rather late in the country's development process, good institutions ready to manage the oil sector and distribute the oil wealth were already in place. A cross country analysis of the resource curse reveals that the oil's effect on a country's economic growth depends on the quality of the country's institutions. A country with good institutions already in place has a positive growth effect from oil, while a country with bad institutions experience a negative growth effect (Mehlum et al. (2006)).

Mehlum, Moene and Torvik shows that the oil has had a positive effect on the Norwegian economy, and nothing in their paper indicates that the large Norwegian oil rents have been harmful for Norwegian women's labor force participation. On the contrary, increased demand for services increased the demand for female labor and led women to participate more in the labor force. Contrast this with the countries in Gulf where women's labor force participation is among the lowest in the world. This make it difficult to accept a hypothesis stating that there is a causal relationship between the value of a country's oil rent and its female labor force participation. The countries in the Gulf region are also heavily influenced by Islamic traditions, and the question I will address in this thesis is whether it is possible to identify a causal relationship between either oil rents and low female labor force participation (FLFP) or the presence of Islam and low Female Labor Force Participation.

The outline of the rest of the thesis is as follow: In section 3 I present the article "Oil, Islam, and Women" written by Michael Ross in 2008. I discuss his argument and methods, and present an alternative specification of his econometric model. In section 4 I develop and present a model where women can face either a high or a low social cost of labor force participation, and where it is possible to substitute household production with a market

produced good. I then analyze different ways of integrating large oil rents in the economy and investigate the effects on women's labor supply. In section 5 I discuss my findings and conclude.

3 Michael Ross' Article "Oil, Islam and Women"

In his introduction to the article "Oil, Islam, and Women" (2008), Michael Ross assert that "... women in the Middle East are underrepresented in the work force and in government because of oil — not Islam." Such a bombastic conclusion is hard to swallow when you come from an oil rich country with one of the highest female labor force participations in the world. In this section I first present Ross' argument, data and method, before I discuss his results and suggest a modification to his econometric model.³

3.1 Ross' argument

Ross' argument goes as follow: A rise in oil production leads to a drop in the sector producing export goods and an increase in the domestic sector and the oil producing sector. Ross makes the assumption that women only work in traded sector while men work in the domestic sector. Women's decision on whether or not to participate in the labor market is affected by the wage they potentially can obtain in the labor market, as well as the household's total income. A drop in the export sector due to large oil revenues reduces the demand, and hence the wage, for female labor. Simultaneously should we expect to observe the opposite effect on the demand for male labor and male wages, as well as an increase in transfers from the government to the households.

Higher male wages and increased transfers from the government lead to higher total income for the households. As income increases, the need for women to enter the labor market is reduced, and so their reservation wage, the minimum wage they require to join the labor force, increases. Combined with a fall in demand for female labor and female wages due to the decline in the export industry, the overall effect on women's labor force participation of an increase in a country's oil revenue is clearly negative.

Ross argues that women's way to political influence traditionally has gone through their participation in the labor market. The second part of his argument is thus that increased oil production leads to lower female labor force participation which in turn reduces women's political influence. The two hypothesis which he seeks to confirm are thus:

³I am very grateful that Ross has shared his data with me.

H1: A rise in the value of oil production will reduce female participation in the labor force.

H2: A rise in the value of oil production will reduce female political influence.

Sachs and Warner found in their much cited working paper from 1997 that a Dutch Disease model has some power when it comes to explaining the resource curse, the observed empirical negative cross country correlation between a countries' economic growth and their amount of resource-based export. The Dutch Disease model, developed and described by Corden and Neary (1982) and further by Corden (1984), explains the mechanisms at work when a country experiences a boom in one of their trading sectors. The economy's real exchange rate will increase, making it cheaper to import other traded goods. Simultaneously the demand for non-traded goods increases as well. Both these effects tend to draw production factors, especially labor, out of the traded manufacturing sector not experiencing a boom, and into the non-traded sector. It is this shrinkage of the traded sector that is referred to as a disease. Ross builds on this tradition when he uses a Dutch disease model as the source of the resource curse in his article.

The key assumption in Ross' theoretical model is that women only are employed in the traded manufacturing sector, while men work in the non-traded sector. His rationale for this assumption is as follows: When the labor market is segregated by gender the number of jobs available for women, as well as their wages, tend to be low. Historically women's way into the labor market has then gone through low-wage export oriented industries and he argues that this justify the assumption of a labor market completely segregated by gender.

3.2 Data, Method and Results

Ross uses time-series data from the period between 1960 and 2002 for 161 countries to estimate the effect of oil rent on female labor force participation in a first differences model with country fixed effects. His dependent variable is the difference in Female Labor Force Participation (FLFP) from one year to the next. His explanatory variables are the differences in *log of GDP per capita*; *squared log of GDP per capita*; *Working Age*, the

fraction of total population that are between 15 and 65; and *Oil Rents per capita*, all of which are lagged one year relatively to the dependent variable.

An interesting feature of this specification is that it is actually the same as regressing the dependent variable on the lagged dependent variable and, a country specific trend and a country specific constant term depending on the country's initial situation:

Starting with Ross' specification:

$$y_{i,t} - y_{i,t-1} = \alpha_i + \beta(X_{i,t-1} - X_{i,t-2}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (1)$$

Moving the lagged dependent variable over to the right hand side and inserting for $y_{i,t-1}$:

$$\begin{aligned} y_{i,t} &= \alpha_i + y_{i,t-1} + \beta(X_{i,t-1} - X_{i,t-2}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \\ &= \alpha_i + (\alpha_i + y_{i,t-2} + \beta(X_{i,t-2} - X_{i,t-3}) + (\varepsilon_{i,t-1} - \varepsilon_{i,t-2})) + \\ &\quad \beta(X_{i,t-1} - X_{i,t-2}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \\ &= 2\alpha_i + \beta(X_{i,t-1} - X_{i,t-3}) + y_{i,t-2} + (\varepsilon_{i,t} - \varepsilon_{i,t-2}) \end{aligned}$$

Repeating the process and inserting for y_{t-2} , y_{t-3} etc... back to $t = 1$ results in:

$$y_{i,t} = t\alpha_i + (y_{i,1} - \alpha_i - \beta X_{i,0} - \varepsilon_{i,1}) + \beta X_{i,t-1} + \varepsilon_{i,t}$$

which can be simplified to:

$$y_{i,t} = t\alpha_i + \psi_i + \beta X_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Where $\psi_i = y_{i,1} + \alpha_i + \beta X_{i,0} + \varepsilon_{i,1}$, a country specific initial value. An alternative representation could be:

$$y_{i,t} - y_{i,1} = (t - 1)\alpha_i + \beta(X_{i,t} - X_{i,0}) + (\varepsilon_{i,t} - \varepsilon_{i,1}) \quad (3)$$

Whether one option for equation 1, 2 or 3, the interpretation is the same. What Ross is estimating is the change in the dependent variable from the initial situation in each and every country, controlled for a country specific, linear trend.

Ross standardizes all his variables so his regressions only say something about how large impact changes in one variable has relative to changes in another. What he finds⁴ is that changes in a country's oil rent per capita have a significant and negative effect on changes in the FLFP. In order to account for potential serial correlation in the error term he uses an AR1 process. When he replaces this process with year dummies, the impact increases in absolute value while sign and level of significance prevail. The interpretation has to be as follow: Over that past 50 years there has been a positive trend in women's labor force participation all over the world. A jump in a country's oil revenues reduces the positive trend effect and slow down women's labor force participation.

This regression with panel data is useful to study the impact on FLFP from variables that varies over time but remain more or less constant between countries. Because the model includes fixed effects it cannot say anything about how variables that differs a lot between countries but stay more or less constant over time within a country affect FLFP. A country's religious tradition and culture belong to this category. The fraction of Muslims in the population is likely to vary a lot between countries, but only experience small changes over time within a country.

Female Labor Force Participation, the dependent variable in the regression, suffer from several drawbacks that might reduce the quality of the estimation: Countries differs in their way of defining and measuring female labor force participation, in whether or not they include foreign workers in the statistics and it does not distinguish between agricultural and non-agricultural labor. In the first regression model already discussed, the two first problems are solved, as long as countries remain consistent in their measurement over time. Ross wants to study the effect on national women's participation in non-agricultural labor. By subtracting foreigner and agricultural labor from the estimates, he obtains a measure on national non-agricultural female labor force participation, but reliable data for these other measures are only available for more recent year. In order to investigate factors that varies between countries, and to use this modified measure of FLFP, Ross runs several cross-country regressions.

The fully specified cross country model with average female non-agricultural labor force participation between 1993 and 2002 as dependent variables includes *Income*; *Squared*

⁴Ross' tables 1, 2, 4 and 5 are included, unaltered, in appendix B

Income, *Working Age*; dummies for *Middle East* and *Communist* countries; an *Islam* variable measuring the Muslim fraction of each country's population and *Oil Rent per capita*. He runs an ordinary least square regression with robust standard errors. The latter to control for heterogeneity in the standard errors.

In his first specification of the model he leaves out both *Islam* and *oil rent*. In the second he includes *Islam*, which get a negative value, but is only significant at approximately 7 percent. In the third regression he includes *oil rent*, but leaves out *Islam*. The oil rent coefficient is negative and significant at 0.1 percent. In the last specification he includes both *Islam* and *oil rent*. The sign on both coefficients remain and the oil rent coefficient stays on the same level of significance. The Islam coefficient loses even more of its significance.

These results lead Ross to accept his first hypothesis, that a rise in the value of oil production will reduce female labor force participation.

His second hypothesis, that a rise in the value of oil production reduces women's political influence, is also studied by using cross country regressions. He has two different measures on women's political influence. The first is the percentage of parliamentary seats held by women in 2002, the second is percentage of ministerial positions held by women in 2002. His independent variables are *Income*; *Middle East*, a dummy for countries in the Middle East and North Africa; *Islam*, the fraction of Muslims in the population, *Oil Rents per capita*; and *Female Labor Force Participation*. He also includes several measures of a country's political institutions: *Polity*, which is drawn from the Polity IV database and is an index of a state's democracy level; *Proportional Representation*, a dummy that indicates that a country's parliament is chosen through proportional representation; and *Closed List*, a dummy indicating whether or not the electoral system has closed party lists.

Ross' main findings are as follow: In all specifications *Oil Rent* has a negative effect on female seats in the parliament, and except for the specification where he includes Female Labor Force Participation, the effect is significant at a 0.1 percent level. When FLFP is included, this one obtain a positive effect at a 0.1 percent level, and it reduces the significance level of *Oil Rent*. The Islam variable gets a negative sign in all specifications

where it is included, but it is never significantly different from zero. The dummy for Middle East and Northern Africa gets a negative sign and remain significant through most of the specifications, except in the case where FLFP is included. The picture is mostly the same, although less significant, when the dependent variable is chosen to be percentage of ministerial positions held by women.

The fact that *Islam* is insignificant in all specification while *Oil Rent* is highly significant is interpreted by Ross as a confirmation of his second hypothesis that an increased value of oil production reduces women's political influence. He further argues that he finds support for his hypothesis that the effect on female political influence works through female labor force participation since including FLFP reduces both the effect and the significance of *Oil Rent*.

3.3 Critique of Ross' Article

I find Ross' article highly interesting. He rises a question that deserves attention, namely that of oil revenues potential adverse effect on men and women's labor force participation. Nevertheless, I do not find the assumption that women only work in traded sector very compelling, and I do think he is too quick in concluding that oil rent alone explain the low female labor force participation in MENA, while acquitting the Islamic tradition completely. I will address these two issues in this section and thus focus on Ross' first hypothesis. Since the topic of this thesis is female labor force participation, I will not address Ross' second hypothesis of whether an increase in a country's oil rent affects women's political influence.

3.3.1 Women only in traded sector

In his theoretical argument, Ross assumes that all women work in the traded sector, and that this represents the only work opportunity for women. With this assumption he takes into account the potential adverse effect of an oil boom on men and women's labor force participation when the labor market is segregated by gender. If large oil revenues remove the demand for female labor without generating new demand in other sectors, then there

obviously will be a negative correlation between a country's oil rent and female labor force participation. The question then is whether or not this is a justified assumption in the first place:

As I have already mentioned, the industrialization process in the oil rich gulf countries has been characterized by import substitution industrialization. The goal of industrialization was to produce goods for the domestic market and to process commodities into more valuable goods that could be exported. This generally implies more capital intensive industries which in turn requires more skilled labor. Given that women traditionally received less education than men, these industries favor male labor.

Export oriented industrialization has traditionally been recognized by use of simple technology that do not require much use of expensive capital. Countries abundant on labor but poor on other resources have had a comparative advantage in production of these goods, the textile industry being a typical example. As wages in industrialized countries increased, it became more profitable for these countries to import textile from a country with access to cheap labor. Jobs in the textile industry did not require workers to be neither skilled nor physically strong, and were therefore accessible for both men and women. One should thus expect to observe a higher female labor force participation in countries pursuing this industrialization process. This development is described in Richards and Waterbury (2008), and Ross uses it as a rationale for his assumption.

However, a potential problem with Ross' assumption is that he does not allow women to move from traded to non-traded sector once an oil-boom has hit the economy. Consider the case of Norway which is a small, open and resource rich economy. In the early phases of the industrialization process, the textile industry played an important role, and employed many women. As pointed out by Mehlum et al. (2008), manufacturing in Norway declined from about 20 percent of GDP in the beginning of the 1970's to 12-13 percent in the early 1990's. The Norwegian textile industry is so to speak gone, and the manufacture industry still in place is often closely related to the oil industry. After Norway started oil production in 1973, the increased demand for domestically produced goods and services, and thus labor to produce these goods and services, was met with increased female labor force participation in the non-traded, labor intensive sectors. Today one observe a fairly high degree of gender segregation in the labor market, and OECD (2002) finds that the degree

of occupational segregation of gender is higher in countries with high degree of female employment like the Scandinavian countries. My point is that although the assumption might be justified when describing a pre-oil economy, excluding women from entering the non-traded sector as a response to changes in the industry structure seems to harsh. As the example of Scandinavia shows, it is quite feasible, although not necessarily ideal, for a country to have both high degree of female labor force participation, and a high degree of gender segregation in the labor market.

3.3.2 Oil – not Islam vs Oil *and* Islam

A typical economic exercise is to maximize someone's utility function given a set of constraints. It is obvious that one can never be worse off in the maximization problem if the constraints, e.g the budget constraint, are loosened. If the global maximum of the utility function was possible to achieve before the loosening, it will also be reachable after, in which case one will be equally well off before and after. However, if the global maximum where out of reach given the previous constraints and a larger budget can bring you closer to this point, then you will be strictly better off with looser constraints.

An inflow of large amounts of oil rent in an economy can be seen as a loosening of the economy's budget constraint. If nothing else changes, i.e. every individual in the economy continue to work in the same firms, producing the same amount of goods and services and earning the same real wage, then it is clear that spending the entire oil rent on importation of consumption goods will increase the individuals utility as long as they have positive preferences for consumption goods. An alternative use of oil rent is to reduce the amount of hours worked, have more time for leisure and still be able to buy the same amount of consumption goods. If there are positive preferences for leisure, this as well will make the individuals better off.

As a third possibility, assume that the society as a whole has strong preferences regarding women's behavior and participation in the labor force. If it is consider to be harmful for a woman's reputation to work, and the family can afford to support her and the rest of the household without her income, then one probably would observe a negative correlation between large oil rents and female labor force participation. In a situation like this, oil

rent would contribute to conserve and confirm gender patterns already in place by making them feasible to sustain.

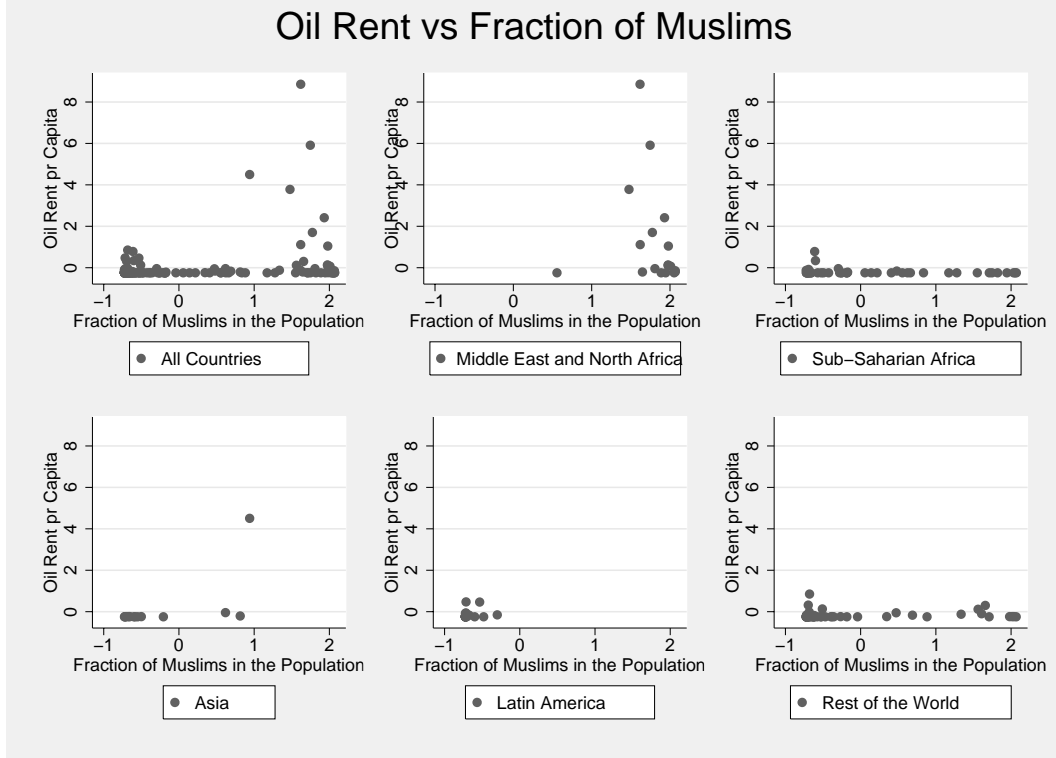
If, on the other hand, the society has the opposite preferences, that they really would like women to participate more in the labor force, then large oil rent can facilitate this as well by financing daycare for children and providing schools and after school care so that women can use their time in the labor market rather than looking after their own children. The more household services that can be provided efficiently in the market, the easier it is for a family to have both husband and wife working. Hence, in this situation oil can have a positive effect on female labor force participation by facilitating women's entry into the labor market.

The point of the preceding intermezzo is to show that although it might be tempting to conclude from an observed negative correlation between oil rent and female labor force participation that there is a causal relation, I claim that the effect might equally well depend on the fundamental preferences in the society. For the sake of the argument, assume that Islamic societies have a strong preference for traditional family values where women take care of children and older relatives and perform all necessary household tasks. Pursuing such a preference is costly to the household and society, because it implies that half of the working age population will not participate in the labor force. A country rich on oil and natural resources can afford to organize the society in this way, while a poorer country, despite having the same fundamental preferences can not. This might explain why one observes significantly lower female labor force participation in the resource rich, labor importing countries in MENA than in the rest of the region.⁵

When running a cross-country OLS-regression with female labor force participation as the dependent variable and Islam and oil rent among the right hand side explanatory variables, Ross, in my opinion, fails to reject the hypothesis that Islam has no effect on FLFP. He first runs a regression without any of them, only controlling for Income, fraction of population in working age, a region dummy for the middle east and a communist variable. He then, in addition, includes first only Islam and finds a negative but insignificant effect, and then

⁵In the resource rich, labor importing countries Oman, Saudi Arabia, Libya, Bahrain, United Arab Emirates, Qatar and Kuwait the female share of total labor force was 6.76% below that of the rest of the region in 2007. The difference is significantly different from zero on a 1.3% level. Data source: World Bank.

Figure 3: Oil Rent pr Capita vs Fraction of Muslims in the Population, by region

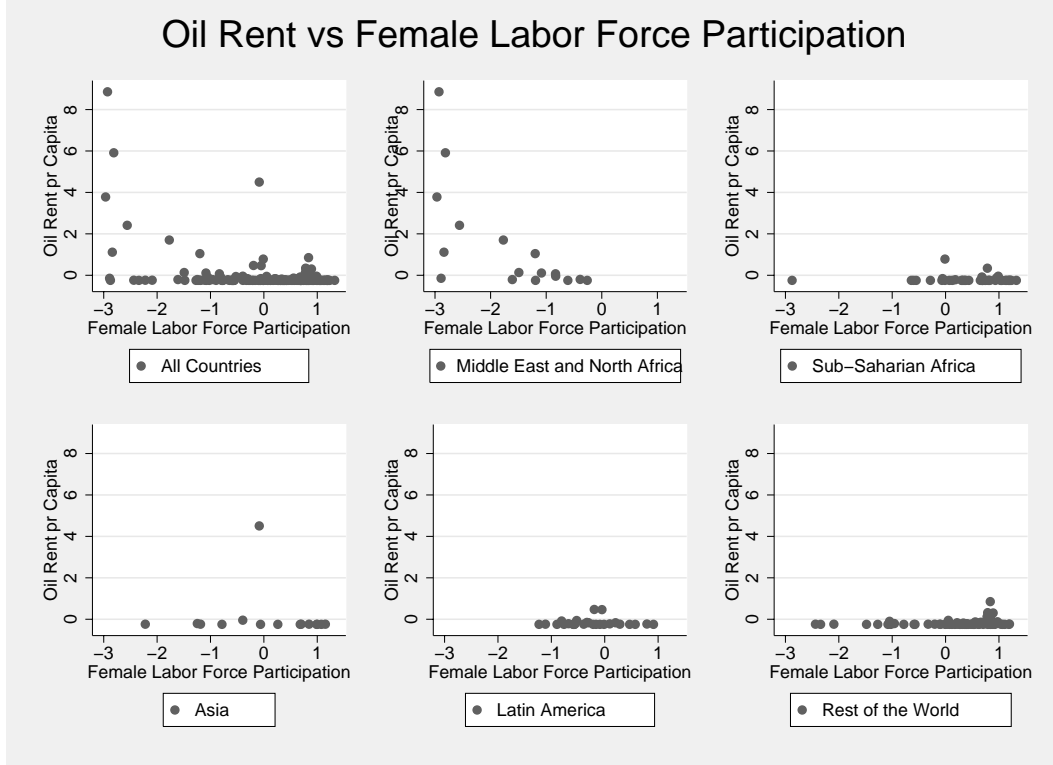


he includes only oil rent and finds a negative and highly significant effect of this. In the last regression he includes both and finds that oil rent remain negative and significant.

I claim that what he should have done is to include an interaction term between Oil Rent and Islam. Figure 3, 4 and 5 are all drawn based on Ross' data set. From figure 3 one see that countries with extremely high oil rents are mostly located in the Middle East and North Africa, and that almost all countries in this region have a very large fraction of Muslims in the population. Figure 4 shows that countries in the Middle East and North Africa generally have lower female labor force participation than countries in other regions, and within this region there is a visible negative correlation between high oil rents and female labor force participation. In the other regions, to the extent that there is any clear correlation visible for the eye, this is rather positive than negative. This is confirmed when studying the correlation between FLFP and oil rent, which is -0.6684 within MENA while 0.0042 in the rest of the sample.

In figure 5 there are three graphs. In the first graph I have drawn the scatter plot between female labor force participation and oil rent pr capita in respectively Islamic and Non-Islamic countries. This graph reinforces the picture that emerged from figure 4. At a first

Figure 4: Oil Rent pr Capita vs Female Labor Force Participation, by region

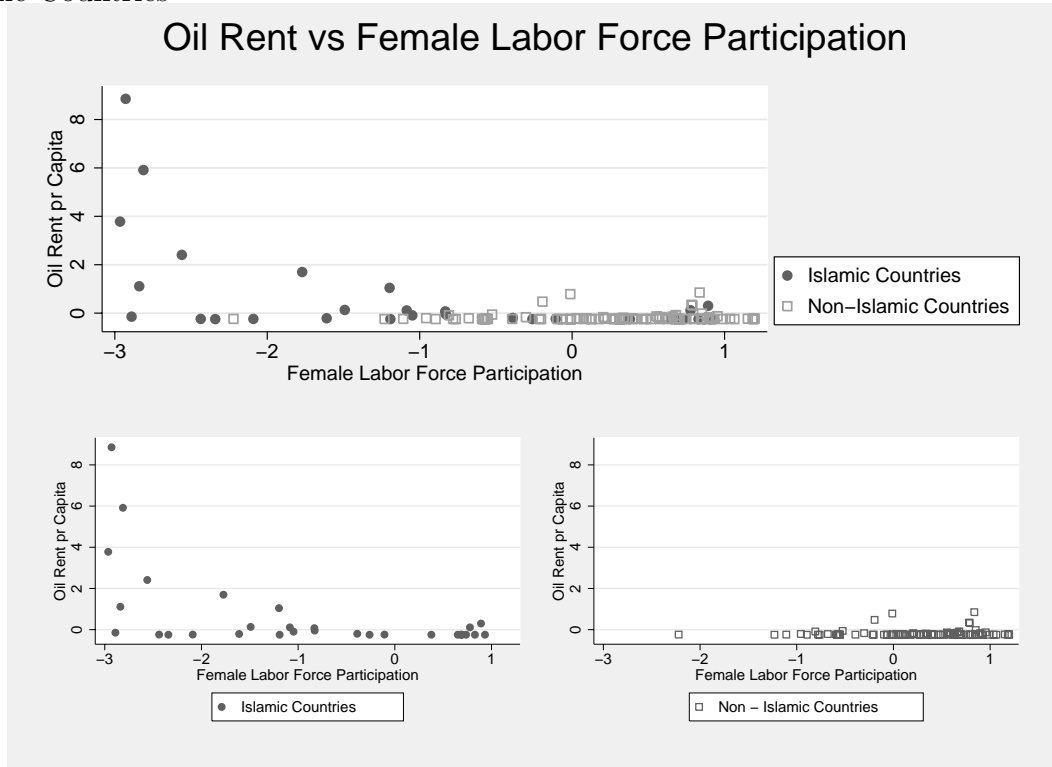


glance, there might seem to be a clear negative correlation between large oil rents and FLFP. However, a closer look reveals that female labor force participation is decreasing in oil rent pr capita only in Islamic countries. In the two smaller graphs below, I have separated the Islamic and Non-Islamic countries into different graphs to make it easier to see the difference between them. Again, to the degree that it is possible to judge with only visible inspection of the data, it seems like the correlation between FLFP and Oil Rent, if there is any, is rather weakly positive then negative in the Non-Islamic countries.

From figure 4 and 5 it is clear that what drives Ross' findings is the negative correlation between oil rent and female labor force participation within the MENA region and within Islamic countries.

Using Ross' data I first estimate the same econometric model as he does. The dependent variable is a modified measure on *female labor force participation*, the fraction of the formal labor force made up of female citizens. This measure is taken from the World Banks World Development Indicators 2005. Since measures that distinguish between agricultural and non-agricultural labor force and foreign and national workers are available for years after 1990, this is used to adjust the measure on FLFP to only represent national women in

Figure 5: Oil Rent pr Capita vs Female Labor Force Participation in Islamic and Non-Islamic Countries



non-agricultural work force. In the regression, the average FLFP between 1993 and 2002 is used.

On the right hand side the following explanatory variables are included:

- *log GDP* – The average logarithm of GDP per Capita in each country over the time period 1993 to 2002. Taking the logarithm implies that the coefficient has to be interpreted as the change in *female labor force participation* when GDP increases with 1 percent. This makes it easier to compare large economies with small ones.
- *log GDP (squared)* – Including this is intended to capture the u-shaped relation between FLFP and income. Higher income has a positive effect on female wages which in turn increases women' labor force participation. But higher unearned household income might have the opposite effect. Note that the total effect of GDP

on FLFP is captured by a combination of the two income coefficients:

$$y = a \ln x + b(\ln x)^2$$

$$\frac{\partial y}{\partial x} = \frac{a}{x} + \frac{2b}{x}$$

- *Middle East* – A dummy variable for the 17 countries in the sample that is defined by the World Bank to belong to the Middle East and North Africa.
- *Islam* – This variable measures the fraction of Muslims in the population. This is not a perfect measure of the influence Islam may have on a society. Other measures could for instance be to which degree sharia, the Islamic law, is implemented in the legal system, the density of mosques in a country, whether or not the form of government is religious or secular, etc. However, to me it seems like the fraction of Muslims in the population is as bad or as good as any other measure, but it is important to remember that it can only be interpreted as an instrument for the real variable *Influence of Islamic traditions*.
- *Communsit* – This is a dummy for the 34 countries in the sample that at some point in time after 1960 have had a communist legal system.
- *Working Age* – fraction of the total population which is between the age of 15 and 64. If this fraction is low, the dependency ratio in the society is high, and it is likely that one observe higher female labor force participation to compensate for the relative small labor force.
- *Oil Rent per Capita* – This is the last variable included by Ross, and it is calculated as the total value of each country's annual oil and natural gas production subtracted the country specific extraction cost and divided by the population.⁶

In my specification I also include an interaction term between oil rents and islam:

- *Oil Rent x Islam* – The interpretation of this is interesting. If the Islam variable is very low, the country in question is a Non-Islamic country. To simplify, assume

⁶For a detailed argument on why this is a better measure on a country's oil wealth than the often used oil export to GDP, I refer to the appendix in Ross' article.

that the *Islam* variable take the value zero, meaning that there are no Muslims in the population. Although the country might have large amounts of oil rents per capita, the variable *Oil Rent* x *Islam* will still be zero. However, if *Islam* is equal to 1, *Oil Rent* x *Islam* will take the same value as *Oil Rent per Capita*. If the hypothesis is that oil rent has a negative influence on female labor force participation, nonoccurrence of Islam may reduce this negative effect of oil rent.

The regression results are reported in table 1. Column 1 is Ross' specification and the results are identical with those he reports in column 4, table 2 in his article⁷. Column 2 is my alternative model where I have kept all Ross' exogenous variables, but in addition included an interaction term between oil rents per capita and Islam. As already mentioned several times, Ross finds that oil rent has a significantly negative effect on female labor force participation, while the Islam-coefficient, although negative, is not significant.

My specification on the other hand, results in a negative effect of the interaction term at a 5 percent level of significance. The interpretation is that the *combination* of oil rents and large influence of Islam is harmful for female labor force participation. Furthermore, in my specification *Oil Rent per Capita* loses its significance and changes sign. Although we do not have sufficient information to conclude that oil rent actually has an impact at all, it is interesting to see that the sign now is positive. Worth mentioning is also that the significance level of *Islam* increases even though it does remain insignificant.⁸

The regressions reported in table 1 shows that the specification suggested by Ross is misleading because it leads the reader to conclude that high oil rents have a negative, causal effect on female labor force participation. His intention is to say something about structural vs cultural causes for the observed low female labor force participation in the Middle East, but he fails to take into account that these factors might to some extent be indistinguishable, at least since he only uses macro data. The fact that the interaction term is sufficient to kill both the size, the sign and the significance of the oil variable,

⁷Included in appendix B.

⁸Since current income obviously is correlated with a country's current oil revenues, I have also estimated an alternative model where I replace current income and squared current income with the average of these during the 1960's. The picture that emerges is the same. Without the interaction term oil rents have a large negative and highly significant effect on FLFP, while with an interaction term included, the interaction term becomes significant at a 1% level, the oil variable loses all its significance and the Islam variable becomes significant at a 5% level.

Table 1: Dependent variable is Female Labor Force Participation (1993-2002)

	(1) FLFP	(2) FLFP
log GDP (mean 1993-2002)	-1.864* (-2.12)	-1.974* (-2.21)
log GDP squared	2.122* (2.58)	2.194** (2.63)
Working age population	-0.350* (-2.47)	-0.320* (-2.22)
MENA	-0.326** (-2.80)	-0.284* (-2.35)
Communist	0.286** (2.74)	0.283** (2.71)
Islam	-0.139 (-1.20)	-0.196 (-1.63)
Oil Rent per Capita	-0.210*** (-3.80)	0.128 (1.01)
Oil Rent x Islam		-0.231* (-2.50)
Observations	167	167
R^2	0.4266	0.4350
Adjusted R^2	0.4013	0.4064

Robust t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Specification 1 is Ross' specification.

Note: All variables are standardized.

while being significant it self, shows that it is the co-occurrence of large oil rents and Islam within a country that lead to low female labor force participation.

The results confirm my claim that oil rents, rather than being negative for womens labor force participation on its own, makes it possible for a society to live by its true preferences. An Islamic country with only limited or no oil rents experiences higher female labor force participation than an oil rich, Islamic country, because it is to costly for the society to let the women stay home. When comparing an oil rich, Non-Islamic country to an oil rich, Islamic country, one would expect to find that the Non-Islamic country has a higher female labor force participation. The results are also in line with the findings of Alexander and Welzel (2009):

Alexander and Welzel investigate the link between Islam and patriarchal values, in an attempt to separate cultural effects from structural ones. They analyze World Value Surveys data and examine whether or not the effect of Islam on patriarchal values vanishes when controlling for structural aspects. Their results suggests that the correlation between patriarchal values and Islam is explained by a combination of structural and cultural factors. Their data allows them to distinguish between individuals that define them self as Muslims and those who do not. They combine this with information on the share of Muslims in a country's population. This make it possible to study Muslims' and Non-Muslims' degree of patriarchal values in respectively Islamic and Non-Islamic countries.

They find that Muslims living in a Non-Islamic country are less patriarchal than Muslims living in an Islamic country. This indicates that there are some structural aspects in Muslim countries that explain the patriarchal view, and not an intrinsic property to Islam itself. However, their data also reveals that Muslims are more patriarchal than Non-Muslims both in Islamic and in Non-Islamic societies. This point the direction of cultural explanation. They also find that being a self-defined Muslim increases the patriarchal values significantly. This holds even when they control for strength of religiosity, education, sex and age. The effect remain also when controlling for Islamic dominance in a country. By using the inverse of the UNDP's "Gender Empowerment Measure" as a direct measure for structural patriarchy, they find that Muslims are significantly more patriarchal than Non-Muslims, independent of whether or not they live in a patriarchal society.

Although I find these findings compelling, it is necessary to point out that Ross' data do not contain sufficient information to state beyond doubt that it is Islam in combination with oil rents that is the driving factor. Consider table 2. Column 1 just repeats my specification from table 1. Column 2 replaces the interaction term between oil rent and Islam, with the interaction between oil rent and the regional dummy variable for MENA. The oil rent per capita variable remains insignificant and the effect of the MENA dummy remains almost unaltered and significant. The coefficient of the interaction term between MENA and oil rent is much smaller than the one for the interaction between Islam and oil rent, but the effect is still negative. A Middle Eastern country with large oil rents is expected to have a lower female labor force participation than a Middle Eastern country without oil.

The third column includes the interaction of both Islam and oil rents and MENA and oil rent. If either one of these had remained significant, it would have been a clear indication of whether it is the combination of oil and Islam or oil and MENA that best explains the data. The fact that both are insignificant leads to the conclusion that there is not enough information in the data to tell which one is the driving factor.

In the next section I use a very stylized model to further investigate the relationship between female labor force participation, the society's preferences toward women in the labor force and oil rents.

Table 2: Dependent variable is Female Labor Force Participation (1993-2002)

	(1) FLFP	(2) FLFP	(3) FLFP
log GDP (mean 1993-2002)	-1.974* (-2.21)	-1.979* (-2.22)	-1.990* (-2.22)
log GDP squared	2.194** (2.63)	2.197** (2.64)	2.204** (2.64)
Working age population	-0.320* (-2.22)	-0.317* (-2.20)	-0.315* (-2.18)
MENA	-0.284* (-2.35)	-0.297* (-2.49)	-0.287* (-2.39)
Communist	0.283** (2.71)	0.276** (2.64)	0.278** (2.67)
Islam	-0.196 (-1.63)	-0.159 (-1.35)	-0.180 (-1.56)
Oil Rent per Capita	0.128 (1.01)	-0.0201 (-0.35)	0.0797 (0.59)
Oil Rent x Islam	-0.231* (-2.50)		-0.121 (-0.84)
Oil Rent x MENA		-0.0841** (-2.73)	-0.0500 (-1.07)
Observations	167	167	167
R^2	0.4350	0.4353	0.4362
Adjusted R^2	0.4064	0.4068	0.4039

Robust t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: All variables are standardized

4 Model

My hypothesis is that different societies may have different views and preferences regarding women's labor force participation and that the effect of large oil rents on female labor force participation therefore necessarily will differ across countries. In this section I develop a simple and stylized model in order to investigate this theory. I consider two scenarios where women face either a high or a low social cost of participation in the labor force because societies have different preferences toward this question. The economy consists of two types of working class households, a class of capitalists and an industry producing a representative consumption good. In addition I will allow for the possibility of buying household services in the market, which work as perfect substitutes for home produced services.

Skilled households: In these households both husband and wife have high education and can be considered skilled labor. By working in the sector producing the consumption good (the C -sector), they earn a wage which again can be used to buy consumption goods and household services. The decision of whether or not to participate in the labor market is discrete, i.e. they either participate and have a full work day, or they do not work at all. I use the consumption good as numeraire so that all other prices and wages are expressed in terms of this good.

To assume that married women take a larger share of the family's household tasks is not very problematic and I simplify this by assuming that women are responsible for all household work. A wife participating in the labor force thus has a positive opportunity cost as she could have spent this time at home, taken care of her children and old relatives and performing other household tasks. The husband's opportunity cost on the other hand is zero since he does not take part in any of these tasks. This implies that the husband will enter the labor market before the wife and since the family need a minimum consumption of the consumption good (C -good), the husband will always work, and work a full day.⁹

If the wife is to join the labor market, she will have to hire domestic help to assure that necessary household services (e.g. babysitting) are performed. In general she will do this

⁹A modification of this assumption could be that women are better at watching children than men are, and so men's opportunity cost is lower than women's, but not necessarily zero.

if the price of this help is less than what she earns in the labor market. If what she has to compensate the maid is more than what she earn, she will prefer to stay home and do the tasks herself. Societies may differ in their view on woman in the labor force, and I take this aspect into account by including a fixed social cost for women who choose to join the labor market. This cost is represented by a_s for skilled women, and are either high or low, respectively denoted $\overline{a_s}$ and $\underline{a_s}$.

I will assume that a woman who is indifferent between joining the labor market or not, will join as long as she can get a job. Consequently, there are three cases to be studied, where $h_{m,s}$ and $h_{f,s}$ are respectively skilled men and women's labor supply, w_C is the wage in the C -sector and p is the price of domestic help.

$$h_{f,s} = \begin{cases} 0 & \text{if } w_C < p + a_s \\ h_{m,s} & \text{if } w_C > p + a_s \\ 0 < h_{f,s} \leq h_{m,s} & \text{if } w_C = p + a_s \end{cases} \quad (4)$$

Case 1 is the situation where the wage in C -sector is insufficient to cover the cost of hiring domestic help and compensate the wife for the social cost of joining the labor market. Under such conditions, no skilled women find it profitable to work, and their labor supply is thus zero. Case 2 is the case where the wage is strictly higher than the total cost of participation in the labor force, and consequently all skilled women chooses to join the labor market. Since there are equally many skilled women as skilled men in the economy, the total labor supply from skilled women is equal that from skilled men. Case 3 is the intermediate situation where a fraction of skilled women work. The wage is exactly equal to the cost of labor force participation. If one more skilled women join the labor market, the wage is forced down and below skilled women's reservation wage, and at least one woman will prefer to withdraw from the labor market, taking the economy back to the equilibrium.

Unskilled households: In unskilled households both spouses have low education and are considered unskilled labor. The husband can still be useful in the production of the C -good by doing manual work requiring brawn, but he gets a lower wage than a skilled

worker. Again the decision of whether or not to join the labor market is discrete. He either join it and work a full day, or he stays home and does not work at all. Assuming that unskilled men also have an opportunity cost of zero, the result is that all unskilled men join the labor market.

The claim that men have an opportunity cost of zero makes men insensitive to the income effect of higher household budgets. However, a small addition to the model may solve this problem: Assume that work in the C -sector requires one to put in some effort and that the marginal cost of effort is constant, while marginal utility of working is decreasing in consumption. As long as the household's consumption is below a certain threshold value, marginal utility of consumption is higher than marginal cost of effort, and the decision on whether or not to join the labor market is the same as described above. If the consumption level in the household increases above this threshold, the disutility of working exceeds the marginal gain, and the labor supply is reduced to zero. The threshold value of consumption is denoted with \overline{C}_C and defined by equation 5 which is the same for both types of household:

$$\frac{\partial U}{\partial \overline{C}_C} = \theta \quad (5)$$

where θ is the constant marginal disutility of working.

Unskilled women are considered unqualified for work in the C -sector, but they can on their spare time decide to work as domestic servants in skilled households. This will reduce their leisure and increase the household's income and thus potential consumption of the C -good. It is natural to assume that their marginal rate of substitution between leisure and consumption is decreasing in absolute value as consumption increases. The more consumption you have the less willing you are to forgo leisure to get some more consumption.

The supply of labor to the C -sector can thus be expressed by the following equation where h is total labor supply, $h_{m,s}$ and $h_{m,u}$ skilled and unskilled men's labor supply, and $C_{C,s}$ and $C_{C,u}$ are consumption of C -good in skilled and unskilled households. $\alpha < 1$ implies that unskilled men are less efficient than skilled men and women and $h_{f,s}$ is the number of skilled women working in the C -sector. Note that this variable is endogenous and depends on the wage in the C -sector, w_C , the price of childcare as stated in equation 4, and might

take the value zero.

$$h = \begin{cases} h_{m,s} + \alpha h_{m,u} + h_{f,s} & \text{if } C_{C,s} \text{ and } C_{C_u} < \bar{C}_C \\ \alpha h_{m,u} & \text{if } C_{C,s} \geq \bar{C}_C \text{ and } C_{C_u} < \bar{C}_C \\ h_{m,s} & \text{if } C_{C,s} < \bar{C}_C \text{ and } C_{C_u} \geq \bar{C}_C \\ 0 & \text{if } C_{C,s} \text{ and } C_{C_u} > \bar{C}_C \end{cases} \quad (6)$$

In case 1 both household types have a consumption level below the threshold value and will supply labor. Case 2 and 3 occur if either skilled or unskilled households have a consumption level above the threshold and thus do not participate in the labor market. Since skilled women's labor supply depend on the availability of domestic help and unskilled women's labor supply depends on the demand for this help, neither group of women participate in the labor market if the other do not. In the last case, both household types have a consumption level above the threshold, and none are willing to supply labor. In this case the economy's consumption would consists solely of imported goods.

Capitalists: In addition to the working class described up until now, the economy also has a class of capitalists. The capitalists own all capital in the economy. Their income is equal to the return on capital, and they use all their income on buying the C -good. They have no demand for household services and do not participate in the labor market. I will assume that the amount of capital in the economy is fixed and equal to \bar{k} . Formally, the capitalists consumption has to satisfy the budget constraint:

$$C_{C,cap} = \beta X_C + R \quad (7)$$

where βX_C is capital's share of production and R are other non-wage income, e.g. transfers from the government.

Production of C -good: The C -good is produced using a Cobb-Douglas production technology exhibiting constant return to scale, taking labor and the economy's fixed

amount of capital as inputs:

$$X_C = A\bar{k}^\beta h^{(1-\beta)} \quad (8)$$

X_C is production of C -good, A is a technology parameter or a parameter that accounts for everything but labor and capital in the production process and h is the number of efficiency units of labor as defined in equation 6.

This sector is governed by capitalistic principles so labor is hired up until the point where the value of the marginal product of labor (MPL) is equal to the marginal cost of labor, i. e. the wage w_C . Taking capital as given, the demand for labor can then be expressed as:

$$h = \left[\frac{(1-\beta)A}{w_C} \right]^{1/\beta} \bar{k} \quad (9)$$

The C -good is a traded good and should be thought of as a bundle of different kinds of consumption goods. If the economy has no other revenues (e.g. oil revenues), the value of import and export of the consumption good is equal, so that the trade balance holds.

Labor market equilibrium in the C -sector requires that w_C is set such that demand for labor equals the supply (eq 9 = eq 6). The equilibrium conditions for the product market is expressed by equation 10 to 12 and implies that the fraction of production that is left after the capitalists have gotten their share, has to equal the total consumption of C goods in the two household types:

$$(1-\beta)X_C = C_{C,s} + C_{C,u} \quad (10)$$

$$C_{C,s} = w_C h_{m,s} + (w_C - p)h_{f,s} \quad (11)$$

$$C_{C,u} = \alpha w_C h_{m,u} + w_H h_{f,u} \quad (12)$$

Production of H -good: The H -good, household services is the domestic services performed by unskilled women in skilled women's households. For unskilled women to be willing to do this, they have to be compensated for their loss of leisure. Since they value leisure relatively more as consumption increases, the compensation ought to depend on

unskilled households' level of C -good consumption, $C_{C,u}$. As in the case of skilled women, the society may impose a social cost on women who join the labor force and work outside their home. For unskilled women this cost is expressed by a_u , which again can take the high value $\overline{a_u}$ or the low value $\underline{a_u}$. As a simplification I assume that the necessary compensation can be expressed as a linearly increasing function of $C_{C,u}$:

$$w_H = a_u + b C_{C,u} \quad (13)$$

a_u is the social cost imposed on unskilled women who join the labor market and b is a constant parameter representing the marginal increase in the necessary compensation as the consumption level in unskilled households increases with one unit. w_H is the wage in the H -sector, which thus increases in $C_{C,u}$.

It is plausible that women working as domestic help and watching other women's children are less efficient than women looking after their own household. If not for anything else, an unskilled woman will have to include transportation costs when considering whether or not to accept to go and work for another woman. When labor is only input, production of household services can be represented by the following production function.

$$X_H = \phi h_{f,u} \quad \text{where } \phi < 1 \quad (14)$$

The price of an unit domestic services is set so that it exactly covers the costs of producing this unit:

$$p = \frac{w_H}{\phi} \quad (15)$$

which in turn, together with the social cost parameter a_s , determines the minimum wage a skilled woman is willing to accept if she is to join the labor force in the C -sector.

Demand for H -goods depends on skilled women's labor force participation in the C -sector and is equal to $h_{f,s}$, any working, skilled woman demand one unit of household services. Production and supply of household services are defined by equation 14, and in equilibrium we have that the supply of household services equals the demand.

$$X_H = h_{f,s} \quad (16)$$

The last equation I will introduce is the one determining the value of the import that is not covered by the value of exported C -goods. Before the economy experience an oil-boom, I assume that there is balance of trade, so that this extra import will take the value zero. However, when introducing an exogenous, large oil rent, the economy can import more C - goods than it export and finance it with the oil rent. The value of this import is determined by equation 17 where I represents this oil financed import.

$$I + X_C = C_{C,cap} + C_{C,s} + C_{C,u} \quad (17)$$

Equation 4 - 17 are sufficient to determine the following 13 endogenous variables:

h , $h_{f,s}$, $h_{f,u}$, X_C , \bar{C}_C , $C_{C,cap}$, $C_{C,s}$, $C_{C,u}$, X_H , w_H , w_C , p and I . This system has one more equation than endogenous variables and is clearly overdetermined. Solving the model require one to drop either equation 11 or 12, since the one left out is indirectly determined by the equilibrium condition 10.

4.1 The Benchmark Situation:

No Oil Revenues, Different Equilibriums :

I now put the framework together and start by describing the benchmark equilibrium situations, where the economy has no oil. The society may either support or oppose women's participation in the labor force and thus impose either a low or a high social cost on women who choose to join the labor market. Throughout this section I assume that the consumption level in any household never exceeds the threshold value \bar{C}_C , so the household will always choose to supply male labor.

I have solved the model using the F-solve function in MATLAB. The .m-file and results of the calculations for a wide range of different scenarios are available in appendix A, and interested readers are referred here. In this section and the next I focus on those mechanism and results I find most relevant, and discuss and explain them in detail.

Skilled women's reservation wage is determined by the social cost they face, which is constant, and the price, p , they have to pay for household services, which in turn depends on unskilled women's reservation wage as defined by equation 13. In order to trace out the

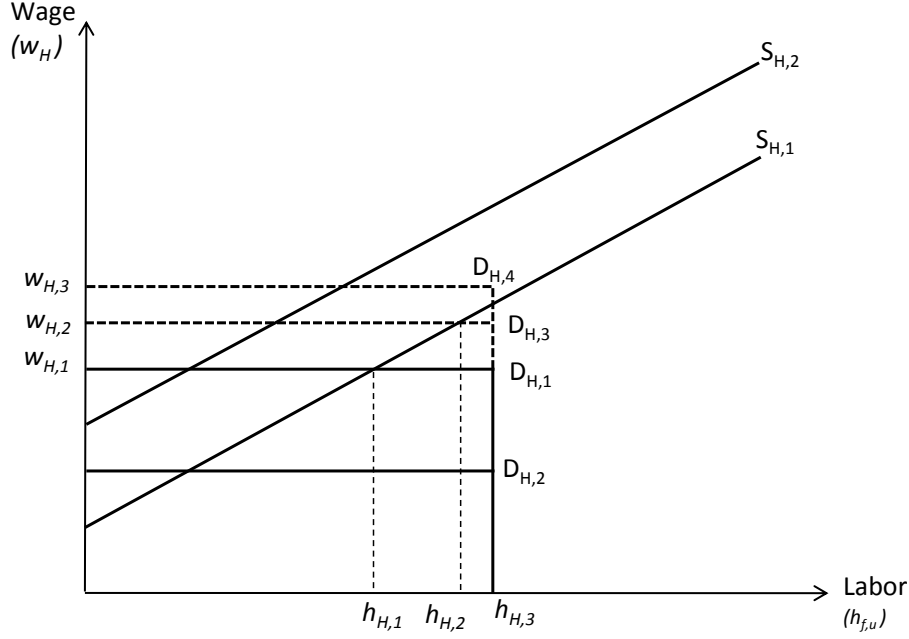


Figure 6: Labor market for household services.

labor supply curve in the C -sector, I start by considering the labor market for production of household services in figure 6.

For a given wage w_C in the C -sector, skilled women are willing to pay $p = w_C - a_s$ for household services. If $a_s = \underline{a}_s$, i.e. the social cost of working is low, their willingness to pay is relatively high, and represented by the demand curve $D_{H,1}$. If the social cost is high, $a_s = \overline{a}_s$, and skilled women's willingness to pay for household services is relatively low. This is represented by the demand curve $D_{H,2}$. The vertical part of the two demand curves is the point where all skilled women are employed in the C -sector and the market for household services is saturated. The vertical distance between the two demand curves, represents the difference between high and low social cost.

The supply curves $S_{H,1}$ and $S_{H,2}$ are unskilled women's supply of labor to the labor market for production of household services. These are increasing in the $(h_{f,u}, w_H)$ plan because as their income increases, whether it is because of higher labor supply or higher wage, the consumption level in unskilled households increases, which in turn has a direct effect on the wage unskilled women require in order to be willing to supply an extra hours of work. $S_{H,1}$ represents the situation where the social cost is low, $a_u = \underline{a}_u$. A higher social cost result in a positive vertical shift in the supply curve, and $S_{H,2}$ thus represent the supply

curve in case of a high social cost, $a_u = \overline{a_u}$.

Figure 6 illustrates two equilibrium scenarios: The first one, $(h_{H,1}, w_{H,1})$ is represented by the intersection between demand curve $D_{H,1}$ and supply curve $S_{H,1}$ where women face a low social cost of working. The other one is at the origin and occur if the social cost is high. In the figure, there is no intersection between the supply and demand curve that represents the high social cost scenario. Given the wage in the C -sector, no skilled women are willing to pay the wage demanded by unskilled women.

If the wage in the C -sector increases, this will increase skilled women's willingness to pay for household services and lead to a shift in the demand for labor in the market for household services. In the case of low social cost, a shift in the demand curve (from $D_{H,1}$ to $D_{H,3}$ in figure 6) will be followed by a movement along the supply curve. The new equilibrium $(h_{H,2}, w_{H,2})$ will have both higher wage and higher labor supply. If the shift is sufficiently large (e.g. $D_{H,4}$), the new wage in the C -sector is strictly higher than what is needed to cover the price on household services and the social cost of working. This will leave the skilled women strictly better off if they participate in the labor force rather than staying home.

In a case where women face a high social cost if they join the labor force, the equilibrium will remain at the origin until the wage in the C -sector is so high that skilled women's willingness to pay is pushed above unskilled women's reservation wage. Above this point, the mechanisms are the same as in the case with low social cost.

Figure 7 represents the supply and demand for labor in the production of the C -good. D_1 represents the demand for labor in the production of C -good, while S_1 and S_2 are the supply curves for labor. The supply curves are piecewise continuous: h_1 represents the supply of labor if all men, but no skilled women, work. If skilled women are going to join the labor force, the wage has to rise above the point where it covers her social cost of working and the cost of buying household services in the market. When all skilled women participate in the labor market, any further shifts in the labor demand will only lead to higher wages since all available labor is employed.

Marginal product of labor in the C -sector is decreasing in labor, and since w_C , the wage in this sector, is set equal to the marginal product, it is easy to see that w_C is pushed down

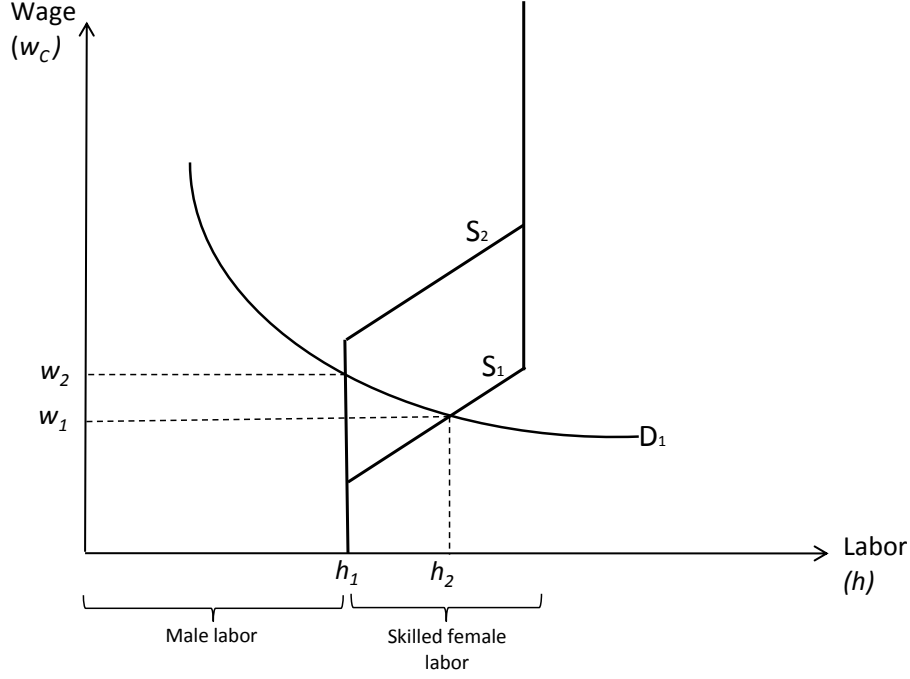


Figure 7: Supply and Demand for Labor in the C -sector

as more workers join the labor market. This is represented by the decreasing curve for labor demand, D_1 . From equation 4, which lists different scenarios for female labor force participation in the C -sector depending on the wage and the price on household services, it is obvious that labor supply among skilled women is zero if w_C is too low, i.e. lower than $p + a_s$, where $a_s \in \{\underline{a}_s, \overline{a}_s\}$. In figure 7, S_1 represents the labor supply in an economy with low social cost of female labor force participation, while S_2 illustrates a case with high social cost. The vertical distance between S_1 and S_2 represents the difference in preferences.

It is easy to see that this result in two different equilibria. In the case where the social cost female labor force participation is high, no skilled women choose to work. This correspond to the equilibrium in origin in figure 6. w_C is too low to compensate first the skilled women for her social cost and then in turn the unskilled woman through a high price on household services. In the case with low social cost, skilled women supply the amount $h_2 - h_1$ of labor to the C -sector.

From the above analysis it is thus clear that the underlying preferences in a society's view on female labor force participation may lead to quite different equilibria. In a situation where the social cost of female labor force participation is low, skilled women make use of

their education and join the labor market. This in turn generates demand for household services in the market, a demand that can be covered by unskilled women who therefore also join the labor market. Both group of women thus choose to participate in the labor market.

From the calculations I have done on the model¹⁰, one can also see that the higher labor force participation among women, increases the production and availability of consumption goods in the economy. This results in higher level of consumption in both type of households when the social cost is low, than when it is high.

4.2 Integrating Large Oil Revenues in the Economy

In this section I investigate the question of main interest: Assume that the economy is hit by an oil boom and suddenly receive a large amount of oil rent. How will this affect women's labor force participation? Does the effect depend on the way these money is phased in to economy? To answer this question I study three broad categories of distribution of oil rents: As a direct transfer to the households; as an investments in the production sector; or as subsidies on goods and services.

Transfer to the Households: The distribution of transfers can of course take many different shapes, but I have chosen to show what happens if an equal transfer is given to each household and if all oil rent is given to the capitalists.

To start with the latter: Letting R_{oil} denote oil revenues, giving all oil revenues to the capitalists implies that their budget constraint (eq 7) is changed to:

$$C_{C,cap} = \beta X_C + R_{oil} \quad (18)$$

If they spend the entire amount solely on increased consumption of C -goods, the only effect of this change is an increase in the capitalists' consumption of C -goods which in turn either have to be covered by less exportation of home produced C -goods, or by increased import. There are no effects on the labor force participation or demand for

¹⁰See appendix A for details

household services, because the capitalists, in this model do not participate in any of these markets. This is obviously an extreme result due to the assumptions in the model, but the point is very clear. If one use large oil revenues only to finance consumption of imported luxury goods for a limited fraction of the country's inhabitants, nothing, neither bad or good happens to the rest of the economy.

If however the oil rents are distributed equally to all working class households, the model predicts a clear, negative effect on female labor force participation. Since working class households in this model has to trade-off consumption with leisure, a boost in the households' income will increase their demand for both leisure and consumption. But since the decision of whether or not to join the labor force is discrete, they either do it and contribute a full days work, or they do not contribute at all. The effect will depend on whether or not the increase in the budget is sufficient to reach the threshold consumption \bar{C}_C as defined in equation 5. In general we therefor have three situations to consider:

1. The situation where the transfer of oil revenues alone is sufficient to ensure a consumption level above \bar{C}_C , meaning that the households now can afford a consumption level so high that none of the spouse find it worth working.
2. The situation where men's income in combination with the transfer is sufficient to reach \bar{C}_C so that the husbands continue to work while the wives stays home
3. The situation where the transfer of oil revenues in combination with the husbands income lead to a consumption level below \bar{C}_C , in which case both men and women have positive preferences for higher consumption rather than leisure, and continue to participate in the labor market as they did before they received the oil transfer.

Should the economy reach the equilibrium described in case 1, all production of C good would stop, no one would work, and they would have to rely on importation of C -good financed by the oil revenue in order to sustain their consumption. This is this model's version of Dutch disease. The wages required to make people wanting to work in the C -sector would have lead to a price on the C -good far beyond any international competitor. The C -sector cannot survive in competition with an international market and is forced out of business.

The economy reaches the case 2 equilibrium independently of whether husbands income plus the transfer only suffice to reach \bar{C}_C in one of the household types or in both. This because the two types of women, skilled and unskilled, depend on each other's labor force participation in order to participate them self.

At a first glance, the last case might give the impression of leaving female labor force participation unaltered, but this is not the case. Although both types of men and skilled women have a discrete labor supply decision, the unskilled women have not. Since the transfer unambiguously lead to an increase in unskilled household's consumption level, the wage that unskilled women require to work as domestic help in skilled households increases as well. This results in a higher price for household and increases the reservation wage for skilled women in the C -sector. The only way skilled women can increase their wage is if more skilled women decides to stay home, meaning that skilled women's labor supply decreases. In turn, this leads to a decrease in unskilled women's labor supply as well, since they now face lower demand for their household services.

This relates quite well to my findings in the previous section, where I argued that the combination of large oil rents and a conservative view on women's participation in the labor market explains the observed low female labor force participation in the Gulf. In this model, an economy which impose a heavy social cost on women who join the labor force will witness that women to a larger extent withdraw from the labor market than in societies where the social cost is low. Rich societies can afford to live after their true preferences to a larger degree than poor ones.

Invest Oil Revenues in the C -Sector An alternative way for the authorities to spend the oil revenues could be to invest them in the production sector, either as an investment in capital and hereby increase the capital stock, or in the process of developing better technology. Whether one option for the one or the other, the result is an increase in the marginal product of labor and a positive shift in the demand for labor. In an economy where women already participate in the labor market, this would lead to an even larger participation rate. Should the threshold where all women participate be reached, the increased demand for labor would result in higher wages and a positive net utility for skilled women.

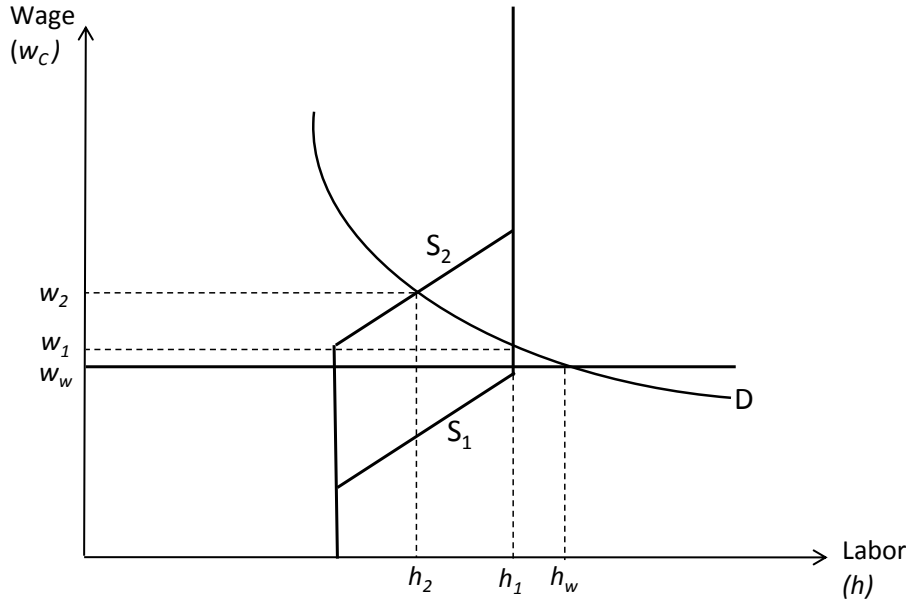


Figure 8: World Market for Labor. w_w is the world market wage.

If no women initially participate in the labor market, it means that the marginal product of labor is below the reservation wage for women. An increase in either the capital stock or an improvement in technology would also in this case increase MPL , but whether or not this generate a positive supply of female labor depend on whether or not the increase is sufficient to tip the threshold where women find it worth participating.

Importing Labor: One feature with the countries surrounding the Persian Gulf is the extremely high fraction of foreigners in the labor force. In Saudi Arabia for example, foreigners constitute at least 50 percent of the total work force. Should one expect this to affect women's labor supply? From the model the answer is yes.

Consider figure 8. The equilibriums in an economy with only access to national manpower, are in the intersections between the demand curve for labor D and the supply curves in an economy with respectively low (S_1) and high (S_2) social cost for women who participate in the labor force. Naturally, the labor force participation is lower among women who face a high social cost. Assuming that labor can move freely across borders, the employers demanding labor can see passed the national supply curve and focus on the world market wage, w_w . In the situation pictured in the figure, the opening of the labor market has no effect on womens labor supply in the case of low social cost, although their wage decreases

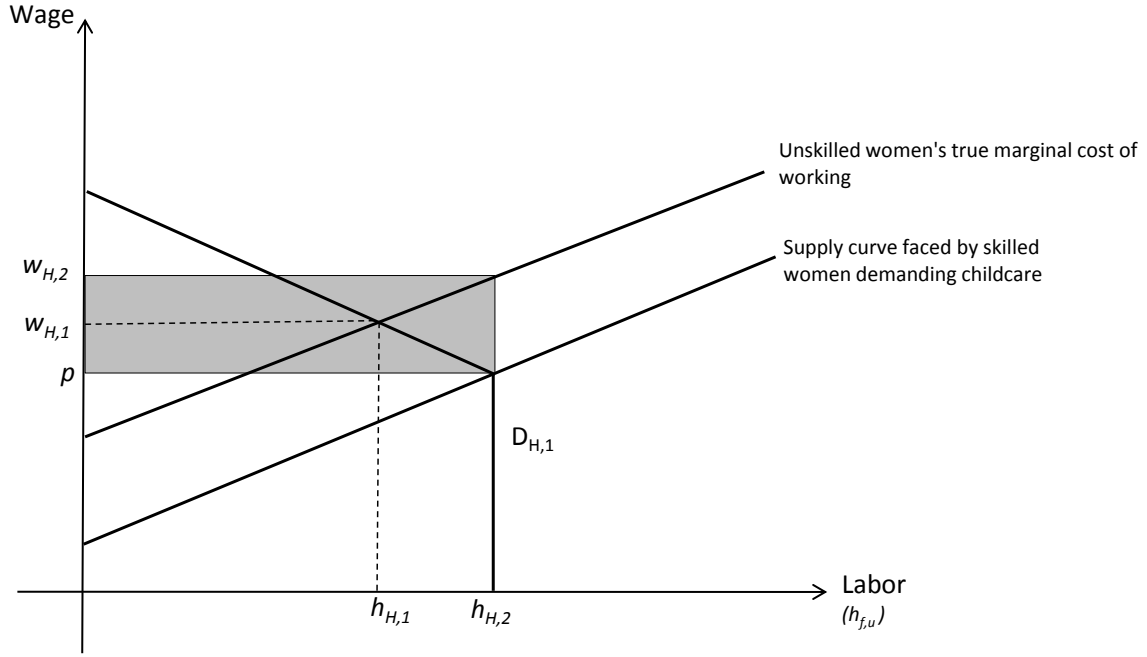


Figure 9: Subsidizing childcare. Total cost of subsidy represented with the shaded area.

from w_1 to w_w . On the other hand, women phased with a high social cost of working now withdraw completely from the labor market because their reservation wage is above the world market wage.

The two scenarios also lead to very different quantities of imported labor. In the first case, where women continue to be in the labor force, import labor only constitutes the distance between h_w and h_1 , while in the second case, where they withdraw completely, import labor has to cover all the demand beyond that covered by national men.

Again the model relates well to the empirics presented earlier. Mehlum et al. (2008) described how Norwegian women responded to the increased demand for services after the discovery of oil, and hereby reduced the pressure on wages and the non-oil manufacture industry. In the oil-rich economies in the Middle - East the process was different: as the demand for labor increased, foreign workers constituted an increasing fraction of the work force.

A subsidy on childcare: The last situation I will consider is if the authorities decide to facilitate women's entry into the labor force through a subsidy on an important part of a woman's household responsibility, and maybe the one that in many cases is most difficult

to combine with a job outside the home, namely childcare. Many household tasks can be postponed to later, but if you have children, you cannot leave them unattended.

If the authorities introduce such a subsidy on childcare, the price on childcare faced by skilled women becomes lower than the true marginal cost of childcare. The difference is covered by the authorities. Assuming that the goal of this measure is to extract all potential labor from skilled women, the minimum required subsidy is the one that makes the price on childcare equal to the MPL in the C -sector when all skilled women participate in the labor force. This scenario is illustrated by figure 9. If the economy initially is in the equilibrium $(h_{H,1}, w_{H,1})$ where only a fraction of the skilled women work, introducing a subsidy equal to the vertical hight of the shaded area moves the economy to a new equilibrium $(h_{H,2}, w_{H,2})$ where all skilled women work. Since the wage and MPL in the C -sector declines as more women join the labor force, the price on childcare has to go down from $w_{H,1}$ to p if all skilled women are to enter the labor force. Unskilled women on the other hand require a higher wage if they are to supply a sufficient amount of labor, and their wage is equal to $w_{H,2}$. The gap is covered by the subsidy.

Another way for the authorities to subsidize childcare, could be to invest in the childcare sector so that ϕ , the productivity parameter increases (see equation 14). Any $\phi > 1$ would for instance imply that the price on childcare falls below the wage of any individual babysitter. If one babysitter can watch the children of two skilled women, the cost for any one of the skilled women is only half of the wage cost.

So far I have assumed that unskilled women watch skilled women's children on their spare time, but with ϕ larger than one, and thus $p < w_H$, all unskilled women would prefer to join the labor market and pay someone to look after their children. In this very stylized model there are no obvious use of this excess supply of labor from unskilled women, but it could be rational to invest in more education and thus increase unskilled men's productivity and make unskilled women qualified for work in the C -sector. I believe this to some degree describes the development in Norway during the second half of the 20th century.

Summarizing: I have presented a simple economic model of female labor force participation and analyzed the effect of large oil revenues when women face different social costs

of labor force participation. To the extent that oil revenue is harmful for female labor force participation it is more due to how these revenues are integrated, rather than the fact that they stem from oil production. Women who face a high social cost of labor force participation have a higher reservation wage, and are more prone to withdraw from the labor market if the economic conditions changes.

5 Conclusion

This thesis focus on the observed low female labor force participation in the oil rich countries surrounding the Persian Gulf. The question is whether this is due to cultural preferences or a necessary consequence of the region's dependency on oil. The short answer to this question is that large oil rents do not necessarily imply low female labor force participation, but in countries with a general opposition against having women in the labor force, oil rents may help to conserve and confirm this gender pattern.

The results from the econometric analysis in section 3 serve as evidence for this conclusion. The interaction term between a country's oil rent pr capita and the influence of Islam, measured as the fraction of Muslims in the population, has negative and significant impact on a country's female labor force participation, while oil rents alone becomes insignificant. This means that oil on its own has no effect on female labor force participation, except in countries where a large fraction of the population is Muslims. The same pattern is observed if one replace Islamic influence with a regional dummy variable for Middle East and North Africa (MENA). There are thus sufficient information to say that there is some characteristics of this region, whether it is the religion or something else, that makes it more difficult for women to gain access to the labor market in situations where the country has large oil rents.

Ideally what I wanted to estimate is the combined effect of being an Islamic country, i.e. a country where the Islamic religion has a large impact on the society, and being an oil rich country. However, my Islam variable is defined as fraction of Muslims in the population, and is only a proxy to the true variable Islamic influence. In my opinion, this is why the results are inconclusive in the question of whether it is MENA or Islam that make a country choose to spend oil rents in a way that has a negative effect on women's participation in the labor force.

I showed earlier that the development in Saudi Arabia and Norway has followed two very different paths since oil production started in Norway in 1973. Saudi Arabia is a very conservative, Muslim country where the entire society is segregated by sex, and where women lack fundamental human rights and are considered to be their fathers' or husbands' property. In Norway, on the other hand, gender equality has been an important

value, and numerous political measures have been introduced in order to promote gender equality.

This relates well to the model I developed in section 4 where I argue that women can face different social costs if they want to participate in the labor market. If the social cost is high and oil revenues are integrated in a way that in general tend to reduce female labor force participation, the negative effect is stronger than when the social cost is low. If the rents rather are integrated in a way that is intended to encourage female labor force participation, this more easily succeeds if the social cost is low. Therefore, if the purpose is to increase women's participation in the labor force, authorities should take care when they decide how they are going to distribute and invest the oil rents. They should also, if possible, try to reduce the social cost that women may face if they participate in the labor force.

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A Matlab code

The following is the matlab code used to calculate the equilibrium for the model economy. I used matlab's F-solve tool, which solves systems of non-linear equations. This version is the benchmark with no oil revenues and low social cost of female labor force participation.

```
function F = modell(x)

% Endogenous variables

h = x(1); % total labor used in the c-sector
wc = x(2); % wage pr efficient unit of labor, c-sector
hfs = x(3); % numbers of skilled women employed in the c-sektor
Ch = x(4); % Demand for market provided household services
Xh = x(5); % Supply of market provided household services
hfu = x(6); % number of unskilled women working as babysitters
Xc = x(7); % Total production of C-good
Ccs = x(8); % Skilled households' consumption of C-good
Ccu = x(9); % Unskilled households' consumption of C-good
wh = x(10); % Wage in H-sector
Ccap= x(11); % Capitalists' consumption of C-good
Import = x(12); %I mport of C-goods

% Parametere
beta = 0.4; % Capital's share of production
A = 1.05; % Technolgy
k = 100000; % Capital stock
hms = 400; % skilled male labor = number of skilled households
hmu = 600; % uskilled male labor = number of unskilled households
au = 1.5; % social cost of working for unskilled women
    % au = 1.5 for low and 2 for high
as = 1.5; % social cost of working for skilled women
    % as = 1.5 for low and 2 for high
```

```

b = 0.18; % as and b determines wh
phi = 0.9; % Production of H-good pr unit of unskilled female labor.
alpha = 0.8; %unskilled men's productivity relatively to skilled ones.
%OI = 50000; %oil income

F = [wc - wh/phi - as;
h - (((1-beta)*A)/(wc))^(1/beta)*k;
h - hms - alpha*hmu - hfs;
Ch - hfs;
Xh - Ch;
Xh - phi* hfu;
Xc - A*k^beta *h^(1-beta);
Ccu - alpha *wc * hmu - wh*hfu;
Ccs - wc*hms - (wc-(wh/phi))*hfs;
wh - au - b*(Ccu/hmu);
Ccap - beta*Xc;
Import - (Ccap + Ccs + Ccu) + Xc];

```

Table 3 gives a summary of the values of the endogenous variables in the model calculated for different scenarios.

Table 3: Computations of different scenarios in the model

	No oil - Benchmark		Oil rent given as transfers to working class households		Oil rent given as transfers to capitalists		Invest oil rent in capital to the C-sector		Invest in new technology	
	Low social cost	High social cost	No women but all men work	Noone work	Low social cost	High social cost	Low social cost	High social cost	Low social cost	High social cost
A	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,2	1,2
h	1038,019744	860	860		1038,019744	860	1160	860	1160	860
wc	3,916140853	4,222223017	4,222223017	63	3,916140853	4,222223017	4,405486324	4,965667919	4,281040148	4,825397734
hfs	178,0197436	0	0	0	178,0197436	0	300	0	300	0
Ch	178,0197436	0	0	0	178,0197436	0	300	0	300	0
Xh	178,0197436	0	0	0	178,0197436	0	300	0	300	0
hfu	197,7997151	0	0	0	197,7997151	0	333,3333333	0	333,3333333	0
Xc	6775,05254	6051,852991	6051,852991	0	6775,05254	6051,852991	8517,27356	7117,457351	8276,67762	6916,403419
Ccs	1441,871871	1266,666905	16266,66691	15000	1441,871871	1266,666905	1865,128762	1489,700376	1796,994481	1447,61932
Ccs/skilled household	4,806239571	4,222223017	54,22222302	50	4,806239571	4,222223017	6,217095874	4,965667919	5,989981604	4,825397734
Ccu	2623,159653	2364,44489	37364,44489	35000	2623,159653	2364,44489	3245,235373	2780,774035	3169,012091	2702,222731
Ccu/unskilled household	3,747370933	3,377778414	53,37777841	50	3,747370933	3,377778414	4,636050533	3,972534335	4,52716013	3,860318187
wh	2,174526768	2,608000114	11,60800011	11	2,174526768	2,608000114	2,334489096	2,71505618	2,314888823	2,694857274
Ccap	2710,021016	2420,741197	2420,741197	0	2710,021016	2420,741197	3406,909424	2846,98294	3310,671048	2766,561368
Import	0	0	50000	50000	0	0	0	0	0	0

A	Technology parameter
h	Total labor in C-sector
wc	Wage per efficient labor unit in C-sector
hfs	Skilled women's labor force participation
Ch	Demand for childcare
Xh	Production of Childcare
hfu	Unskilled women's labor force participation
Xc	Production of C-good
Ccs	Consumption of C-good in skilled households
Ccu	Consumption of C-good in unskilled households
wh	Wage for babysitters
Ccap	Capitalists' consumption of C-good
Import	Import of consumption good
Subsidy	Total value of the subsidy on childcare

B Tables from Ross (2008)

TABLE 1. Pooled Time-Series Cross-national Regressions, with First Differences and Fixed Effects

Dependent variable is Female Labor Force Participation, 1960–2002

	(1)	(2)	(3)	(4)
Income (log)	−0.011 (0.36)	−0.039 (1.19)	−0.014 (0.53)	−0.051 (1.08)
Income squared (log)	0.017 (0.52)	0.049 (1.46)	0.021 (0.75)	0.021 (0.43)
Working Age	0.115 (4.67)***	0.115 (4.66)***	0.066 (2.73)**	0.177 (13.65)***
Oil Rents per capita		−0.026 (4.02)***	−0.017 (2.34)*	−0.049 (4.33)***
Observations	5234	5234	5168	5395
Countries	161	161	159	161
R-squared: within	.005	.008	.003	.05
R-squared: between	.16	.18	.19	.22

Note: Absolute value of t statistics in parentheses. *Significant at 5%; **significant at 1%; ***significant at 0.1%. Country fixed-effects are used in each estimation. In column 3, the two most influential countries have been dropped from the sample. In column 4, year dummies were included in place of the AR1 process.

TABLE 2. Cross-national Regressions on Female Labor Force

Dependent variable is Female Nonagricultural Labor Force Participation, 1993–2002

	(1)	(2)	(3)	(4)
Income (log)	−1.334 (1.58)	−1.499 (1.72)	−1.757 (2.06)*	−1.864 (2.12)*
Income squared (log)	1.615 (2.02)*	1.735 (2.11)*	2.053 (2.55)*	2.122 (2.58)*
Working Age	−0.386 (2.74)**	−0.395 (2.75)**	−0.34 (2.45)*	−0.35 (2.47)*
Middle East	−0.521 (6.30)***	−0.407 (3.48)***	−0.413 (4.91)***	−0.326 (2.8)**
Communist	0.290 (2.79)**	0.292 (2.80)**	0.283 (2.74)**	0.286 (2.74)**
Islam		−0.170 (1.51)		−0.139 (1.2)
Oil Rents per capita			−0.225 (4.41)***	−0.21 (3.8)***
Observations	167	167	167	167
R-squared	0.38	0.40	0.42	0.43

Note: Robust t statistics in parentheses. All variables are standardized. *Significant at 5%; **significant at 1%; ***significant at 0.1%.

TABLE 4. Cross-national Regressions on Female Seats in Parliament

<i>Dependent variable is parliamentary seats held by women (%), 2002</i>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income (log)	0.311 (3.80)***	0.259 (2.81)**	0.364 (4.39)***	0.320 (3.41)**	0.329 (3.74)***	0.39 (4.13)***	0.367 (4.13)***	0.779 (5.68)***
Middle East	-0.378 (6.07)***	-0.261 (3.09)**	-0.278 (4.62)***	-0.193 (2.42)*	-0.08 (0.84)	-0.233 (2.82)**	-0.253 (3.28)***	-0.182 (1.28)
Islam		-0.178 (1.93)		-0.139 (1.56)	-0.103 (1.17)	-0.18 (1.85)	-0.144 (1.50)	-0.123 (0.71)
Oil Rents per capita			-0.232 (3.32)***	-0.218 (3.32)***	-0.152 (2.16)*	-0.258 (3.40)***	-0.238 (3.46)***	-0.317 (3.64)***
Polity						-0.158 (1.54)	-0.298 (2.94)**	-0.294 (1.97)
Proportional Representation							0.316 (4.30)***	0.013 (0.10)
Closed List								0.269 (2.94)**
Female Labor Force Participation					0.309 (3.68)***			
Observations	161	161	161	161	160	161	161	88
R-squared	0.21	0.23	0.25	0.26	0.33	0.27	0.35	0.40

Note: Robust t statistics in parentheses. All variables are standardized. *Significant at 5%; **significant at 1%; ***significant at 0.1%.

TABLE 5. Cross-national Regressions on Female Ministerial Positions 2002

<i>Dependent variable is ministerial seats held by women (%), 2002</i>					
	(1)	(2)	(3)	(4)	(5)
Income (log)	0.250 (2.82)**	0.239 (2.50)*	0.282 (3.01)**	0.278 (2.73)**	0.281 (2.76)**
Middle East	-0.244 (4.94)***	-0.218 (3.21)**	-0.181 (4.76)***	-0.174 (2.98)**	-0.141 (2.31)*
Islam		-0.039 (0.49)		-0.012 (0.14)	-0.002 (0.03)
Oil Rents per capita			-0.139 (2.30)*	-0.138 (2.23)*	-0.117 (1.83)
Female Labor Force Participation					0.094 (1.26)
Observations	155	155	155	155	154
R-squared	0.11	0.11	0.12	0.12	0.12

Note: Robust t statistics in parentheses. All variables are standardized. *Significant at 5%; **significant at 1%; ***significant at 0.1%.